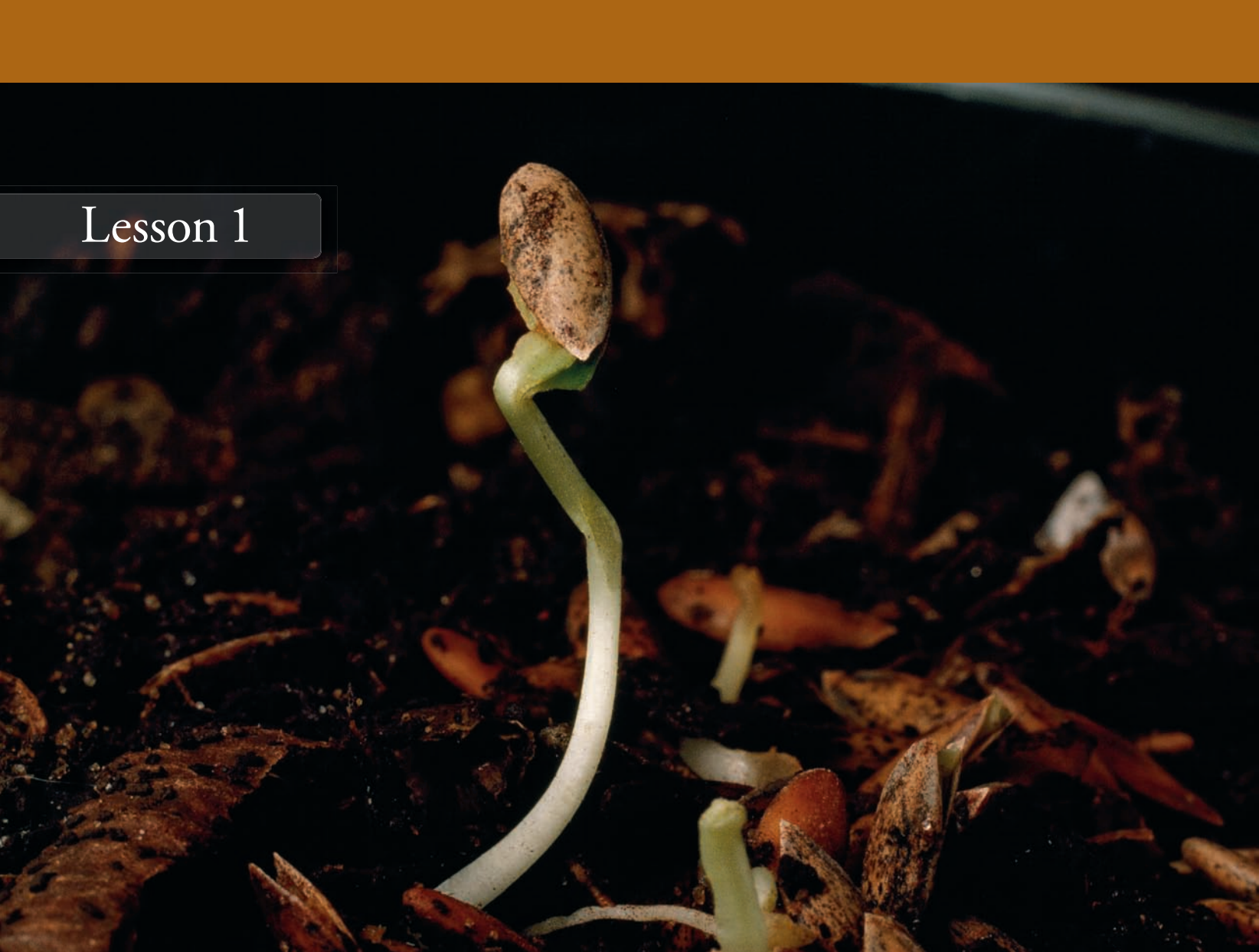


## Lesson 1



Cantaloupe sprouting in compost

# Breaking It Down

When studying food chains and food webs, students typically place decomposers in the last trophic level, where they feed on dead animals or plant parts. This lesson challenges that perspective, helping students understand the true significance of decomposers.

Beginning with this first lesson, students learn how decomposers fit into multiple trophic levels, break down matter, and help cycle nutrients in all ecosystems.

This lesson introduces students to the microscopic, yet dynamic, world of decomposers. Students read about food chains found in various types

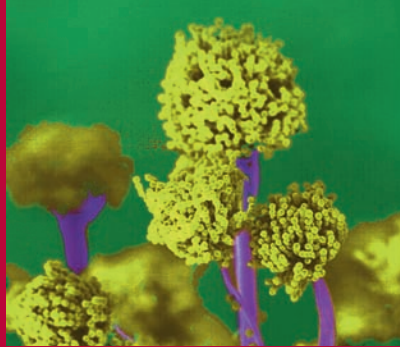
of compost systems in *California Connections: Wonderful Compost* and identify the producers and consumers mentioned in the reading. Through discussion, students identify decomposers in the story and their role in the food chain, learn the term “decomposition,” and recognize that decomposers interact with

the “living” as well as the “dead.” This lesson prepares students to explore the processes by which decomposers help cycle nutrients in ecosystems and support human practices such as food production (agriculture) and waste management.

## Learning Objective

Give examples of organisms that are decomposers.

Provide examples of human practices that directly depend on the cycles and processes involving decomposers in terrestrial, freshwater, coastal, and marine ecosystems (e.g., their role in food production and waste management).



making it useful and accessible to plants and animals.

Humans build compost bins or piles as a means of creating a maintained habitat for decomposers and encouraging the decomposition process. In compost bins, fruit and vegetable scraps play the role of the producers, providing energy and matter for food chains. Invertebrates such as earthworms and pill bugs act as consumers, eating decomposers in the process of scavenging on dead plant matter. Meanwhile, decomposers such as bacteria and fungi feed on the bins' plant matter and the wastes of the earthworms and pill bugs. As decomposers obtain energy and matter from the fruit and vegetable scraps and consumer wastes, they break them down into their simplest components, such as carbon, nitrogen, hydrogen, and oxygen. In this sense, a compost bin provides a close-up view of some of the natural system interactions that occur within terrestrial, aquatic, and marine ecosystems.

## Background

In food chains and food webs, decomposers often appear to be an afterthought. Since the food chain highlights energy transfer, producers become the stars; that is, they garner the most attention because they are capable of converting the sun's energy to matter. Naturally, consumers come next, eating producers and other consumers and then, usually, passing on their energy and matter by being eaten themselves. If depicted at all, decomposers are isolated in food chains. They are the organisms at "the end of the line" that "eat the dead

stuff." The word "decomposer" brings to mind unattractive molds that ruin our breads and fruits, or bacteria that we cannot even see but that cause infection and illness.

A decomposer's relationship to the rest of the components in an ecosystem is complex. In addition to being consumers themselves, feeding on organic matter, decomposers are food for other consumers and aid most consumers in their digestive processes. Furthermore, decomposers break down organic matter into its simplest chemical components,



Compost bin

## Key Vocabulary

**Bacteria:** Microscopic, one-celled organisms that play a key role in decomposition.

**Decomposers:** Bacteria, fungi, and mold that obtain energy and matter by breaking down the remains of dead organisms into their chemical and mineral components.

**Decomposition:** The breaking down of dead organisms into their chemical and mineral components.

**Matter:** What all things are made of.

## Toolbox



### Summary of Activities

Students read a story about three approaches to composting, identify the decomposers in the described compost bins, and diagram the food chains represented. They set up a composting lab using bananas and yeast, and make predictions about the decomposition process.



### Instructional Support

See Extensions & Unit Resources, page 30.

#### Prerequisite Knowledge



##### Students should know:

- what plants need to survive.
- the basic components of soil.

##### Students should be able to:

- define the term “food chain.”
- identify producers and consumers within food chains.
- generate a reasonable prediction based on prior knowledge or experience.
- use a gram scale to determine the weight of an object.

#### Advanced Preparation



##### Gather and prepare Activity Masters.

##### Gather and prepare Materials Needed:

- Cut bananas into one-inch slices.

##### Word Wall Cards:

- Choose an area on the wall to place the Word Wall Cards for the unit.

##### Make Storage Space:

- Create a space (preferably in a cabinet) for storing pairs of sealed plastic bags with composting samples.

##### Prepare Composting Lab Materials:

- Prepare a set of the following materials for each group of four students: two slices of banana on a paper towel, two plastic bags that can be sealed, a teaspoon, and a marker. You may want to place the materials for each group on a plastic tray for easy management.
- Empty the yeast from the packets into the extra plastic bag for easy access during the lesson.





## Materials Needed



### My Decomposition Book:

- Provided separately

### Activity supplies:

- Bananas: four per class, ripe
- Dry active yeast: four packets per class
- Knife: one per class
- Paper towels: one per group of four
- Self-sealing plastic bags: two per group of four students, plus one extra for the teacher
- Teaspoons: one per group of four
- Trays: one per group of four

### Class supplies:

- Chart paper (optional), markers, masking tape, stapler, staples

### Unit Dictionary:

- Provided separately

## Visual Aids



No visual aids are required for this lesson.

## Duration



### Preparation Time

45 min.

### Instructional Time

50 min.



## Safety Notes

Students should not eat or inhale yeast, or handle the knife.

## Activity Masters in the Supporting Materials (SM)

**California  
Connections:  
Wonderful  
Compost**

SM, Pages 7–11  
One per student

# Procedures

## Vocabulary Development

Use the **Unit Dictionary** and the **Vocabulary Word Wall Cards** to introduce new words to students as appropriate. These documents are provided separately. Ask students to write their name in the space provided in the Unit Dictionary.

### Step 1

Ask students to explain what a food chain is and to give examples of food chains. (*A food chain shows how energy in food moves from one living thing to another. It also shows where living things get their energy [what they eat]. One example might be a plant with a seed, which a mouse eats; an owl then eats the mouse.*) Draw or write one of the food chains students describe on the board.

Ask students to identify the producers and consumers in the food chain on the board. (*Answers will vary; students should name the plants [or plant parts] as producers and the animals and people as consumers.*)

### Step 2

Ask students, “Where do producers get their energy?” (*From the sun*) “Is the sun all that plants need to grow?” (*No, they also need water and nutrients from the soil.*) “Where does the soil get the nutrients it contains?” (*Answers may vary. Students may know that the nutrients in soil come from dead plants and animals.*) Tell students that the soil gets the nutrients it contains from plants and animals through an important process called “decomposition.”

### Step 3

Distribute and have students read **California Connections: Wonderful Compost** (Lesson 1 Activity Master). After students have finished reading the story, refer to the term and definition of “decomposer” written on the board or on chart paper (see Advanced Preparation) and ask students to identify the decomposers in the story. (*Mites, pill bugs, snails, springtails, beetles, ants, flies, earthworms, and bacteria*)

Help students to see how the decomposers in the story fit into the food chain by asking the following questions:

- What organisms ate the decomposers? (*The worms ate the decomposers.*)
- On what things did the decomposers feed? (*The decomposers fed on the fruit and vegetables and the wastes of the worms.*)
- What happened to the things on which the decomposers fed? (*The decomposers broke down the things they fed on into their simplest parts.*)

### Step 4

Have a student volunteer come up to the board and diagram the food chain in the story that included the earthworm and bacteria. (*apple core > bacteria > earthworm > bacteria*) Ask students what they think would happen to the food chain if the decomposers were not there. (*The fruit and vegetables would not get broken down. The dead earthworm would not get broken down. The wastes of the worms would not get broken down. The worms would not have bacteria to eat.*)

Tell students that compost bins are not part of nature, and ask them where decomposition might happen in nature. (*In a garden, on a forest floor*) Ask students to give examples of what worms and bacteria help to break down besides fruit scraps like apple cores. (*Answers will vary, but should include leaves, tree trunks, flowers, fruit, and dead animals.*)



## Step 5

Organize the class into groups of four. Distribute a copy of *My Decomposition Book* to each student. Have them put their names on the cover and turn to page 1. Point out the “Decomposition Vocabulary” heading at the top of the page. Instruct students to read the Key Vocabulary words on the board, find those words on their “Decomposition Vocabulary” pages, and write the definitions from the board in their copies of *My Decomposition Book*.

Distribute the composting lab materials (see Advanced Preparation) while students are working on their vocabulary.

## Step 6

Tell students that they are going to work in groups to prepare a composting demonstration of their own. Instruct one student in each group to write their initials and the date on both plastic bags and the word “yeast” on one and the words “no yeast” on the other. (Write the word “yeast” on the board to help students with spelling.)

Instruct another student in each group to place a slice of banana in each of the bags.

Circulate around the room with the bag of yeast to give each student a look at it. Tell the class that yeast is a decomposer—a living thing that breaks down the sugar in other living things.

When you get to each group, have a third student from the group use the teaspoon to take half a spoonful of yeast from the bag and sprinkle it onto the banana slice in the bag that is labeled with the word “yeast.” Check to make sure that the other bag in each group is marked “no yeast” and contains a slice of banana.

Tell the fourth student in each group to carefully seal both bags.

## Step 7

Tell the groups to open their copies of *My Decomposition Book* to page 3, titled “**Banana Composting Lab Sheet.**” Ask students to write their predictions as to what they think will happen to the bananas in each of the bags. Invite students to share their predictions with the class. Give students time to answer the questions at the bottom of the page.

Have the student who marked the bags for each group carefully bring both bags to the area where their “compost” will be stored, and have the rest of the group make sure that the remaining materials are back on the plastic trays or in the center of the workspace.

## Step 8

Collect students’ copies of the *My Decomposition Book* when they have completed their answers to the questions (they may need homework time for this) to use in assessment.

# Lesson Assessment

## Description

This lesson introduces students to some examples of decomposers and the role of decomposition in breaking down dead matter into its chemical components. Students' answers to the questions on the **Banana Composting Lab Sheet** on pages 3 and 4 of *My Decomposition Book* demonstrate their ability to give examples of decomposers and explain how natural systems and humans depend on them.

## Suggested Scoring

Use the Answer Key and Sample Answers provided on page 39-40 to assess student work.

## Answer Key and Sample Answers



## Banana Composting Lab Sheet

## Section 1: Predictions

What do you think will happen to the banana slice in the bag with yeast?

I predict that Based on the information available, students will probably predict that the banana will decompose.

What do you think will happen to the banana slice in the bag without yeast?

I predict that Students may predict that the banana will or will not decompose.

## Section 2: Observations

Use this space to draw what the banana slices look like.

A. Beginning Date: The date should be the day on which the demonstration took place.

Bag with Yeast	Bag without Yeast
<p><i>Student drawings should show the bag, the slice of banana, and the presence of yeast.</i></p>	<p><i>Student drawings should show the bag and the slice of banana.</i></p>





### Banana Composting Lab Sheet

Draw what you see in each bag:

B. Ending Date: \_\_\_\_\_

Bag with Yeast	Bag with No Yeast
<p><i>Student drawings should show the bag, the slice of banana, and the change in the banana after the experiment.</i></p>	<p><i>Student drawings should show the bag, the slice of banana, and the change in the banana after the experiment.</i></p>

### Section 3: Questions

What decomposers did you learn about in this lesson?

*I learned about worms, bacteria, and yeast.*

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

How are decomposers helpful?

*Decomposers are helpful to other plants and animals because they break down things we throw away to make compost. They help put nutrients in the soil. The nutrients help grow food and other plants that keep food chains going.*

\_\_\_\_\_

\_\_\_\_\_



## Wonderful Compost



The warm days of summer turn cooler. Tree leaves shake and rustle in the wind. It is October, and crisp red apples ripen on the trees. In the fall, Juliana Kelly loves to pick apples. Her family goes to an apple orchard every year.

The orchard is in the foothills of the Sierra Nevada Mountains. Its name is Apple Hill. Juliana picks sweet, red apples and puts them in her basket. She will eat the apples in pies, as a snack, and in her school lunch.

At home, Juliana helps her mother make apple pies for the neighbors. She carefully takes the core out of each apple. All of these apple cores have to go somewhere. Juliana has some choices. She can put the apple cores in the trash. A garbage truck will pick up the trash and take it to a landfill. Juliana has another choice. She can save the apple cores for the family compost pile.



Apple tree



Apple core

Juliana decides not to put the apple cores in the garbage. Instead, she adds them to the compost pile in her backyard. She throws the apple cores on top of the compost pile with other vegetable, fruit, and food scraps. Then she adds some grass from the lawnmower bag. She sprinkles some rich, black soil on top.

The apple cores and the cut grass soon begin to rot. Scientists use the word “decompose” to explain what happens to the food scraps. Tiny organisms live in the

pile. Bacteria and fungi change the chemistry of the food, and break it down into nutrients that enrich the soil. Chemical decomposers are tiny. People need a microscope to see them. Mites, pill bugs, snails, and springtails live in Juliana's yard. So do beetles, ants, flies, and earthworms. They all find their way to the compost pile. These physical decomposers or scavengers grind, bite, chew, and tear the food into tiny pieces. They work with bacteria

and fungi. Together they turn the food scraps into compost.

Juliana knows that the decomposers need help. They must have water, air, and lots of food to make healthy compost. Juliana sprays her compost pile with water every few days. She uses a shovel to turn the compost pile. Turning the pile gives the decomposers a fresh supply of air. She also makes sure they have lots of fresh food scraps.

The compost is ready to use in a few months. It smells and looks like rich, healthy soil. Juliana puts the new compost in her garden. She mixes it with the soil. Then she plants pumpkin seeds and tomato seeds. She waters them well. Soon she will see tiny plants begin to sprout. Juliana will watch her pumpkins and tomatoes grow. Her family will begin to eat them when summer comes. Juliana will remember her



Apples in compost pile

compost each time she bites into a juicy tomato.

Juliana's mother takes a fresh apple to work. After she eats her snack, she puts the apple core in a covered box. In the box are hundreds of wriggling red worms. Tiny decomposers also live in Mrs. Kelly's box.

The red worms begin to eat the apple core. Their intestines are rich with juices. These juices break down the food. The worms leave behind droppings. The name for their droppings is "castings." Tiny

decomposers will break down the castings and release vitamins and minerals. These are good for plants. Kelly will use the c



Red worms feeding

to help her garden grow.

When a worm dies in the worm box, tiny bacteria go to work. They break down the carbon, nitrogen, and protein in the worm's body. Bacteria need carbon and nitrogen for energy. They need protein to grow and multiply. Decomposers like bacteria leave their own waste behind. This waste is rich in nitrogen, phosphorus, and magnesium.



Green waste collection

decompose food waste. Vermicomposting is a good choice for people who want to compost but do not have a big backyard. A box of special red worms takes little space. People can buy the worms online or at a local nursery. The worms need bedding like shredded newspaper. They need a steady supply of food scraps. They need someone to make sure their home doesn't get too wet or too dry.

Many classrooms have worm bins. Sometimes students put the castings in their school gardens. Other students take the castings home for their houseplants.

Lucas Garcia is a young boy who lives in Alameda, a town near San Francisco. He does not have a garden. But he knows how to use his family's food scraps for compost. Lucas reminds his family to put their food waste in a special bucket by the sink. When it is

full, he dumps it into a green waste cart outside the house. Mrs. Garcia puts grass into the green waste cart after she mows the lawn.

Each week Lucas pushes the green cart to the street. A special green truck picks up the Garcias' green waste. The truck stops at every house in Alameda. The green waste goes to one big composting place. There, decomposers and scavengers turn the waste into compost. Other cities send their green waste to the same place. California has so much green waste that it creates 4 million tons of compost each year.

Farms, vineyards, and orchards use the compost that Lucas helps the city make. Farmers in the Central Valley, Napa Valley, and Sonoma Valley add compost to their soil. They add compost to orange, avocado, and almond

## California Connections: Wonderful Compost

Lesson 1 Activity Master | page 5 of 5

*Tractor turning compost pile*

trees. Compost also helps grapes, tomatoes, and other crops. Farmers who use compost can water less. They can also cut back on use of chemical fertilizers, which can sometimes pollute the environment and make animals sick. Compost makes the soil and plants healthier. Using compost is good for farmers. It is also good for our land, food, and water.

Making compost means putting less in the garbage can. Less trash means fewer garbage

trucks. This means less traffic and pollution. Less traffic and pollution can mean better air to breathe. Landfills will fill more slowly if people make less trash. Many landfills are built on open space that provides habitat for wild animals. When new landfills are built, habitat for animals is often destroyed. Finding new places to take our garbage is very difficult. Every person in California makes about 58 pounds of trash each month. You probably already recycle

bottles, cans, and paper. How much less trash would you make if you made compost?

Juliana and Lucas feel good about composting their food waste. They use what some would call garbage to make soil healthier. They know that making compost with the help of decomposers is an important step. Their families and their friends can enjoy healthy food and safe water. Food grown in composted soil can improve the quality of life for all.